USS-T. Nazarova

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3 INVESTIGATION OF METEORIC DUST WITH THE AID OF ROCKETS AND SATELLITES 5

BY

6 T. N. Nazarova 9

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INVESTIGATION OF METEORIC DUST WITH THE AID OF ROCKETS AND SATELLITES

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by T. N. Nazarova

SUMMARY

The results are presented of meteoric dust investigation with the help of rockets and Earth's artificial satellites in USSR for the period from 1957 to 1966. Measurements of spatial density of meteoric particles were conducted with the aid of piezoelectric sensors along flight trajectories of spacecrafts in the vicinity of the Earth, and also in the direction from Earth's orbit toward and from the Sun.

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The investigations of meteoric particles were conducted in the course of numerous decades by optical and radar methods, and also by way of collection and analysis of meteor bodies having fallen on Earth. These investigations allowed us to study the meteor matter sufficiently completely.

Determined on the basis of observation of meteorbodies at the moment of time of their encounter with the Earth were the velocity vector, the mass, density, composition and the spatial density of particles with mass $m > 10^{-4}$ g. Analysing these data, one may obtain information relative to meteoric particles of indicated dimensions in interplanetary space.

As to particles with smaller masses, up until now only the integral characteristics of particles and their spatial distribution in interplanetary space could be obtained on the basis of photometric study of zodiacal light and of the F-component of solar corona. The extrapolation of data, characterizing particles with $m > 10^{-4}$ g, on the basis of particles of smaller dimensions is not always legitimate or proportional (in particular as regards the character of particles' spatial density variation with the decrease of their mass).

With the appearance of rockets and AES it became possible to register separate particles with masses to about 10^{-13} g near the Earth as well as in interplanetary space. During the creation of registering apparatus, certain physical phenomena were utilized, which attend the meteor body impact against an obstacle.

*5 ISSELDOVANIYA METEORNOY PYLI S POMOSHCHYU RAKET I SPUTNIKOV. 6

When a meteoric particle, flying with a velocity $\sim$ 5 km/sec (relative to the satellite) hits the obstacle, which is the measurement device, the particle explodes, whereupon the pulse of sensor's material, ejected at explosion, exceeds significantly the impulse of the particle itself. This "reactive" impulse received by the sensor, is a certain function of meteoric particle's mass and velocity.

The theoretical calculation, performed by K. P. Stanyukovich [1], has shown that for great velocities the registered pulse is proportional to the energy E of the particle. The law $I \propto E$ is not universally adopted. M. A. Lavrent'yev assumes [2] that $I \propto mv^{1.6}$, whereas in American works formula $I \sim mv$ is adopted, where m and v are respectively the mass and the velocity of the particle. When processing our experimental data we started from the law $I \propto E$.

For the registration of reactive pulses a ballistic piezoelectric sensor was utilized [3]; it has parted cells: a mass cell and an elasticity cell. The flexure of the elastic cell induces deformation of the piezoelectric elements, which induce electric voltage. The sensor's absolute calibration can be perfo ed by observing the rebound of the little sphere of known mass, falling from specific height. Indeed, for real values of collision times with the sphere, the sensor operates as a ballistic device, just as when it is hit by a meteoric particle.

When meteoric particles hit the sensor, there appear on the piezoelements voltages in the form of short-lived damping oscillations, which enter the amplifier-transformer assuring the resonance amplification of signals, their partition by amplitude in bands, the memorizing of number of impacts in trigger elements and the delivery to telemetry of the information from each element of the memory system.

Thus, the various construction-type piezoelectric sensors applied by us allowed the registration of the number of meteoric particle impacts per units of area and time and a certain function of the mass and velocity of a particle, apparently close to its energy.

The estimate of the mass of a particle naturally depends on the adopted velocity magnitude. When processing the results of our first measurements, the particle velocity was assumed to be equal to 40 km/sec. The ideas expressed by Whipple [4] about the encounter velocity of meteor particles with the satellite as being $\sim$ 15 km/sec appear to us as quite well founded. This is why conversion was made for the first experiments, and in subsequent operations the encounter velocity of particles with the satellite was taken equal to 15 km/sec.

Compiled in Table 1 are the results of investigations of meteoric particles on Soviet rockets and satellites [5, 6]. The areas of operational surface S, and in the case of geophysical rockets, the effective area, are given for all the experiments, as well as the device's operation time t, the impact f equency N and the altitude range H. The apparatus' working off was performed in the experiments with geophysical rockets. The impact frequency of meteoric particles registered in these experiments contains an indefineteness (factor of the order of 3).

TABLE 1

Spacecraft	Date	S, m^2	t, sec	S · t $m^2 \cdot sec$	H, km	M, g	N $m^{-2}sec^{-1}$
Geophysical rocket	24.V 1957	4	134	536	100—200	10^{-8}	0,06
	25.VIII 1957 28.II 1958	4 4	148 85	592 340	100—200 126—297	10^{-8} 10^{-8}	0,05 0,75
Third satellite	15.V 1958 г. 16—17.V 1958 г. 18—25.V 1958 г.	0,34	$1,8 \cdot 10^{4}$	$6 \cdot 10^{3}$	400—1880 400—700 400—700	$6 \cdot 10^{-8}$—$2 \cdot 10^{-7}$ $6 \cdot 10^{-8}$—$2 \cdot 10^{-7}$ $6 \cdot 10^{-8}$—$2 \cdot 10^{-7}$	7 $5 \cdot 10^{-4}$ $< 10^{-4}$
First cosmic rocket	2.I 1959 г.	0,2	$3,6 \cdot 10^{4}$	$7,2 \cdot 10^{3}$	2000—360 000	$2 \cdot 10^{-9}$—10^{-7} 10^{-7}—10^{-6} $> 10^{-6}$	$< 2 \cdot 10^{-3}$ $< 5 \cdot 10^{-4}$ $< 10^{-4}$
2nd cosmic rocket	12.IX 1959	0,2	$1,1 \cdot 10^{4}$	$2,2 \cdot 10^{3}$	2000—360 000	10^{-9}—$4 \cdot 10^{-8}$ $4 \cdot 10^{-8}$—$4 \cdot 10^{-7}$ $> 10^{-7}$	$< 5 \cdot 10^{-3}$ $< 5 \cdot 10^{-5}$ $9 \cdot 10^{-5}$
AIS "LUNA-3"	4—18.X 1959	0,1	$2,3 \cdot 10^{5}$	$2,3 \cdot 10^{4}$	102.000 470.000	$7 \cdot 10^{-9}$—$2 \cdot 10^{-8}$ $2 \cdot 10^{-8}$—$6 \cdot 10^{-8}$ $> 6 \cdot 10^{-8}$	$4 \cdot 10^{-4}$ $2 \cdot 10^{-5}$ $4 \cdot 10^{-6}$
AMS "MARS-1"	1.XI 1962 2.XI—30.XII 1960 г. 31.XII 1962 —30.I 1963	1,5 1,5 1,5	$6 \cdot 10^{5}$ $2,7 \cdot 10^{6}$ $1,5 \cdot 10^{6}$	$9 \cdot 10^{5}$ $4 \cdot 10^{6}$ $2,5 \cdot 10^{6}$	$6,6 \cdot 10^{3}$—$42 \cdot 10^{6}$ $42 \cdot 10^{3}$—$23 \cdot 10^{6}$ $23 \cdot 10^{6}$—$45 \cdot 10^{6}$	$> 10^{-7}$ $> 10^{-7}$ $> 10^{-7}$	$7 \cdot 10^{-5}$ $< 2 \cdot 10^{-6}$ $5 \cdot 10^{-5}$
AES "ELECTRON-2	30—31.I 1964 г.	0,03	$5,4 \cdot 10^{4}$	$1,6 \cdot 10^{3}$	7130—400	$6,5 \cdot 10^{-9}$—$2 \cdot 10^{-8}$	$1,1 \cdot 10^{-1}$
						$6,5 \cdot 10^{-9}$—$2 \cdot 10^{-8}$ $6,5 \cdot 10^{-9}$—$2 \cdot 10^{-8}$ $6,5 \cdot 10^{-9}$—$2 \cdot 10^{-8}$ $> 1,3 \cdot 10^{-8}$	10^{-1} $6 \cdot 10^{-3}$ $4 \cdot 10^{-3}$ 10^{-3}
	11—13.II 1964 г.	0,03	$1,5 \cdot 10^{5}$	$4,5 \cdot 10^{3}$	7130—400	$> 1,3 \cdot 10^{-8}$	$2,4 \cdot 10^{-3}$
	23—25.II 1964 г. 29.II 5.III 3.II—5.III	0,03 0,03 0,03 0.03	$1,6 \cdot 10^{5}$ $8 \cdot 10^{4}$ $5 \cdot 10^{4}$ $1,7 \cdot 10^{6}$	$4,8 \cdot 10^{3}$ $2,4 \cdot 10^{3}$ $1,5 \cdot 10^{3}$ $5 \cdot 10^{4}$	7130—400 7130—400 7130—400 7130—400	$4,4 \cdot 10^{-9}$—$1,3 \cdot 10^{-8}$ 10^{-8}—$4,4 \cdot 10^{-8}$ $3,3 \cdot 10^{-9}$—10^{-8} $> 3,3 \cdot 10^{-8}$	$5,8 \cdot 10^{-3}$ 10^{-3} $1,5 \cdot 10^{-3}$ $7,5 \cdot 10^{-4}$
AES "ELEKTRON-4"	11.VII—1.IX 1964 г.	0,03	$3,6 \cdot 10^{6}$	10^{5}	7046—405	$6,5 \cdot 10^{-9}$—$2 \cdot 10^{-8}$	$8 \cdot 10^{-5}$
AIS "ZOND-3"	18.VII 1965 г.	1,5	$1,6 \cdot 10^{7}$	$2,4 \cdot 10^{7}$	$260 \cdot 10^{6}$	$> 10^{-7}$	$7 \cdot 10^{-6}$
AIS "VENERA-2"	12.XI 1965 —26.I 1966	1,5	$6,4 \cdot 10^{6}$	$9,6 \cdot 10^{6}$	$28 \cdot 10^{6}$	$> 10^{-7}$	$3 \cdot 10^{-5}$

N.B. AIS means "automatic interplanetary station"
AES " artificial Earth's satellite
"VENERA" means VENUS

The increased density of meteoric particles near the Earth, observed from U.S.rockets in the 100 - 150 km altitude range, was registered in the USSR during experiments performed at 100 - 300 km.

The work concerned with the study of atmosphere brightness and carried out lately from rockets in the 120 - 450 km altitude range [7] allowed the evaluation of the density of scattering matter in that range. According to Mikirov data the density of aerosol matter at 450 - 500 km has a value equal to 10^{-20} g/cm^3. This estimate is the lower limit. Therefore, the density of dust matter at 500 km is no less than by one order greater than its density in interplanetary space.

Observation of twilight sky glow provides an independent corroboration of the existence of increased density of dust particles near the Earth [8, 9]. From photometric observations of twilight sky brightness N. B. Divari determined the concentration of dust at 100 km, found to be equal to $2 \cdot 10^{-4}$ cm^{-3}, which exceeds by 6 - 7 orders the concentration obtained from experiments on rockets and satellites. Divary explains this discrepancy by the presence in that region of tiny dust that can not be registered with the aid of rockets and satellites, but which scatters the solar radiation. The fact that the concentration of tiny dust responsible for the twilight scattering of solar radiation drops with the increase of altitude substantially more rapidly than the concentration of coarser particles registered on rockets and satellites may, according to [9], by considered as the proof that the altitude region from 100 to at least 300 km is the place of formation of tiny dust particles, as a result of grinding of the near-Earth dust cloud, or the place of their accumulation.

Several hypotheses are brought forth in order to explain the existence of a dust cloud about the Earth [10 - 16].

Apparently, so far none of these hypotheses, explaining the presence of increased density of meteoric particles near the Earth, may be finally accepted as yet.

The investigation of meteor matter with the aid of rockets and satellites has shown that its spatial density decreases with the distance from the Earth. For particles with mass of 10^{-8} g the number N of impacts in the 100 - 300 km altitude range is $N = 3 \cdot 10^{-2} \div 7 \cdot 10^{-1}$, and in the 400 - 2000 km range it is $N \sim 10^{-3}$ impacts/m^2 sec. In ranges of tens and hundreds of thousand kilometers from Earth $N = 9 \cdot 10^{-4} \div 10^{-3}$ impacts/m^2 sec according to measurements on the 2nd and 3rd cosmic rockets, whereas on the first cosmic rocket no impacts were registered during the time of $3.6 \cdot 10^4$ sec. According to measurements on Explorer-6 and Pioneer-1, $N = 5 \cdot 10^{-6} \div 4 \cdot 10^{-5}$. The great divergence in the data obtained may possibly constitute an indication on density fluctuation of meteor matter in interplanetary space. Extreme estimates of spatial density of meteor matter in the zodiacal cloud, obtained by a photoelectric method, give $N = 10^{-4} \div 10^{-5}$ m^2 sec^{-1}.

Whipple noted a strong dependence N(h). However, the variation of N with the distance from Earth through distances $\sim 10^4$ km is difficult to describe by a single simple dependence N(h). The drop of N is steeper in the 100 - 2000 km altitude range than beyond 2000 km.

The mean reduced curve for the number of impacts of sporadic meteoric particles with masses from 10^{-7} to 10^{-11} g, plotted by Alexander, MacCracken et al in 1962 [17] (Fig.1), shows a good agreement of experimental data (including those of Elektron-2 and Electron-4, added to Fig.1) despite the fact, as already mentioned, that there is discrepancy in the assumed dependence of the pulse I, registered by sensors, on the mass and velocity of the particle in Soviet and American works. In the latter it is assumed

$$I = mv,$$

whereas in the former

$$I = A\frac{mv^2}{2},$$

where m and v are the mass and the velocity of the particle. Apparently, in the final resort, the discrepancies in the numerical value of the coeeficinnt and in the values of velocity adopted for the calculation lead to accord in the final results within the limits of measurement precision.

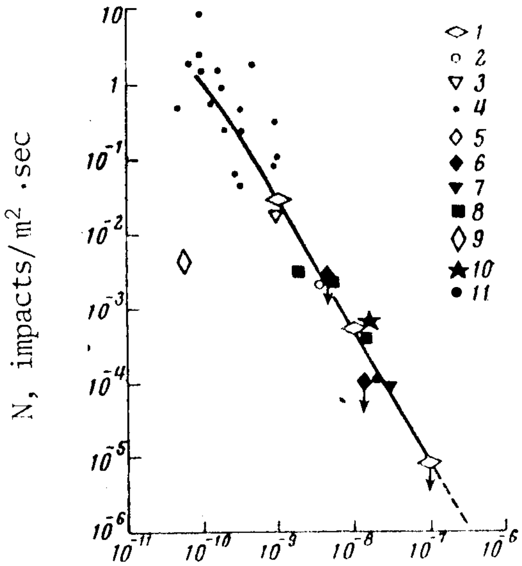

Fig.1. Mean reduced curve of the distribution of meteoric partocles by masses in the vicinity of the Earth according to observations from rockets and Earth's artificial satellites

1) Explorer-8 (USA); 2) Vanguard-3 (USA); 3) Explorer-1 (USA); 4) U.S. rockets; 5) 3rd AES (USSR); 6) 2nd cosmic rocket (USSR); 7) 2nd cosmic rocket (USSR); 8) AIS Luna-3 (USSR); 9) Pioneer-1 (USA); 10) Elektron-2 (USSR); 11) Elektron-4 (USSR)

The data on meteoric particle registration relative to obstacle perforation from Explorer-16 [18] and Ariel-2 [19] for a mass range $\sim 5 \cdot 10^{-8} - 10^{-11}$ g do not fit the curve of Fig.1. This corroborates the earlier assumption by Whipple on the basis of meteor observation from the Earth of the existence of meteor bodies with densities ~ 0.5 g/cm^3 [20].

Measurements with the aid of rockets and satellites have shown that the density of meteoric particles is subject to spatial and temporal fluctuations. Besides streams there were observed separate clusters of meteoric particles with irregular spatial particle density in them. The linear dimensions of these clusters varied within broad limits, reaching millions of kilometers. There apparently exist also very rarefied formations that are difficult to make apparent on account of their low spatial density.

Clusters of micrometeoric particles, not observed on Earth and not belonging to meteor streams known on Earth, were detected with the aid of satellites. Between 30 January and 10 March three meteor particle clusters were registered on Electron-2 during an exposure time of 479 hours (see [21]). They were Observed from 14 to 49 hours with a temporal distance of 144-177 hours between them, when not a single impact was measured. The linear dimensions of clusters reached 3 to 5 million km. The first of them, registered on 30-31 Jan. 1964 was sufficiently dense to allow the determination of the direction of its motion. 185 impacts were registered during $\sim$ 15 hours. The distribution of impacts along the orbit permitted the outlining over it the part, to which corresponded only three of the 185 impacts (Fig.2). Such a distribution of impacts is possible in the case when the Earth passes through the cluster of meteor particles (similarly to stream crossing). In this case, the greater or smaller part of satellite orbit is found to be shielded by the Earth at a corresponding angle between the satellite orbit plane and the concentration velocity vector.

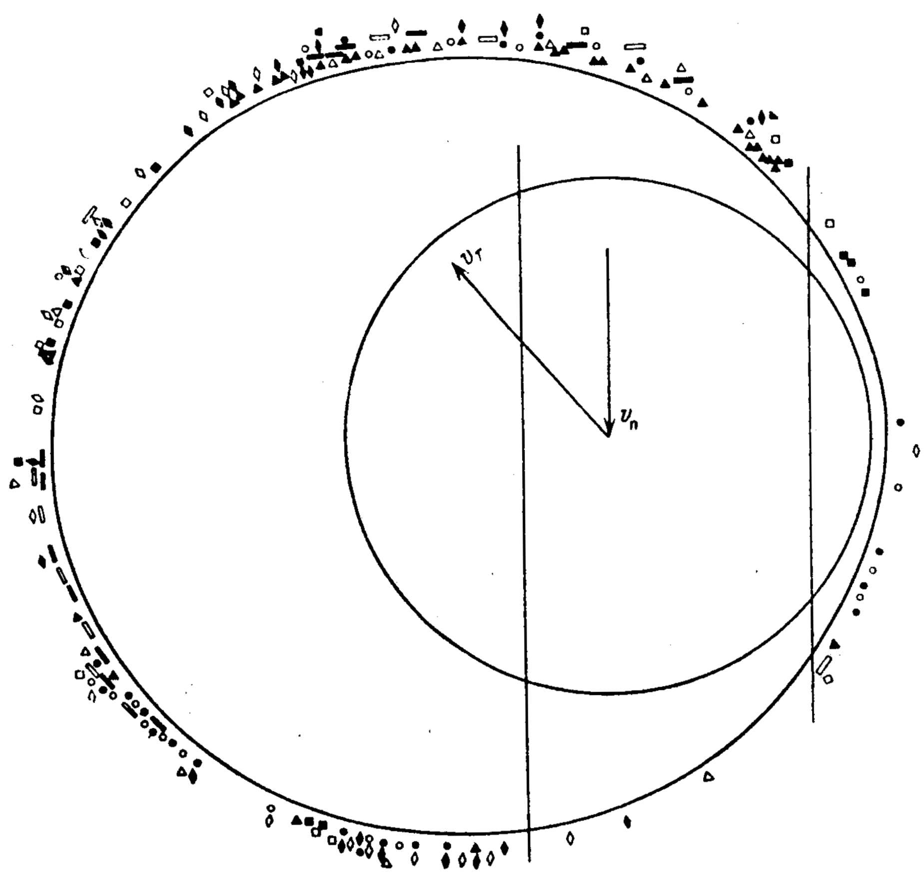

Fig.2. Concentration of meteoric particles observed on 30-31 January 1964

v_T is the Earth's velocity, v_n the velocity of the stream. The impacts corresponding to different convolutions are shown by different signs

The geometrical consideration of the problem has shown that in the given case this angle is equal to $\sim$ 36°, and the angle between the direction of concentration's velocity vector and the Earth's velocity vector is equal to $\sim$ 42°.

If we assume that the concentration had a maximum possible rate of 42 km/sec over the distance from Earth to Sun, the mean relative encounter velocity of meteoric particles with the sensors constituted $v_1 = 61$ km/sec. The average number N_1 of impacts would be in this case $1.1 \cdot 10^{-1}$ impacts/m^2 sec.

As in our previous works, we utilized for the estimate of masses of registered particles the relation $I \sim mv^2 / 2$, in the assumption that $v = 61$ km/sec.

The data on the distribution of particles by masses in the concentration observed on 30 - 31 January are compiled in Table 2.

TABLE 2

Masses of particles g	Number of particles
$4{,}4 \cdot 10^{-9} \geqslant m_1 \geqslant 1{,}3 \cdot 10^{-9}$	166
$10^{-8} \geqslant m_2 \geqslant 4{,}4 \cdot 10^{-9}$	10
$3{,}3 \cdot 10^{-8} \geqslant m_3 \geqslant 10^{-8}$	7
$m_4 \geqslant 3{,}3 \cdot 10^{-8}$	2

As may be seen from this Table, the distribution of particles by masses for this concentration cannot be characterized by a single law. In the formula

$$F(M) \sim 1 / M ,$$

characterizing the law of particle distribution by masses, $n > 2$ for m_1 and m_2, and $n < 2$ for m_2, m_3, and m_3, m_4.

Prior to 10 March 1964, and so long as the apparatus was functioning, two more concentrations of meteoric particles were observed from 11 to 13 and from 23 to 25 February. Since during that time only a small number of impacts were registered (in one case 10, in the other 24), it was not possible to determine the possible direction of cluster displacements, and for the estimate of the mass of particles their velocity of 15 km/sec was assumed, which is usually taken by us for sporadic meteoric particles.

The number of registered impacts of particles with mass $6.5 \cdot 10^{8} \geqslant m \geqslant 2 \cdot 10^{-8}$g was in these case $N_2 = 2.4 \cdot 10^{-3}$ and $N_3 = 5.8 \cdot 10^{-3}$.

From 29 February to 10 March we registered still four more impacts, of which two for about 22 hours from 29 February to 1 March and two on 5 March for about 14 hours.

It should be noted that the average number of impacts for particles with mass $6.5 \cdot 10^{-8} \geqslant m \geqslant 2 \cdot 10^{-8}$g from 3 February to 10 March during a time of 460 hrs constituted $7.5 \cdot 10^{-4}$ impacts/m^2 sec, which fits well the reduced curve composed by Alexander et al (see Fig.1).

The concentration of micrometeoric particles, not coinciding with streams known on Earth, were also observed earlier. Concentration of particles with masses $2 \cdot 10^{-7}$ g $\geqslant m \geqslant 6 \cdot 10^{-8}$ g at $v = 15$ km/sec was registered near the Earth on the 3rd satellite on 15 May 1958. N constituted for it from 4 to 11 impacts/m^2 sec which is about three and one half orders more than the concentration observed in subsequent days. In this concentration (cluster) the mass of particles could have been of the order of $5 \cdot 10^{-10}$ g in the assumption that its velocity was 70 km/sec.

The stream of sporadic meteors not registered on the ground was also observed by American researchers on Explorer-1 [22].

The interplanetary station (AIS) Mars-1 allowed the investigation of meteor matter beyond the Earth's orbit, at great distances from the Sun. On the day of launching, 1 September 1962, the Earth and AIS Mars-1 alongside with it crossed the Taurides stream. During 100 minutes of flight 60 impacts of meteoric particles with masses $> 10^{-7}$g were registered at the distance from 6600 to 42000 km from the Earth. The average impact frequency constituted $7 \cdot 10^{-3}$ impacts/m^2 sec. Since for sporadic meteor bodies the number of impacts by particles of the indicated mass is about 10^{-5} impacts/m^2 sec, it may be considered that all the registered particles belonged to the stream.

The spatial density of meteor bodies in the strea was extremely irregular. The particles moved in space by separate clusters observed at distances of 4000-45000 kn from one another. The measured spatial density of meteor bodies, aver aged by impact accumulation time (2 min.), fluctuated within the limits $0.35 \div 5.4 \cdot 10^{-6}$ m^{-3}, i. e. one meteor body in a cube with a 60 - 140 m edge.

In the second half of November and in December no impacts were registered in the course of observations amounting to some 7.5 hours in the aggregate, and carried out at a distance of some 23 million km from the Earth, i. e.. it may be assumed that the data on the number of sporadic meteor bodies with masses $\geqslant 10^{-7}$g obtained for the neighborhood of the Earth's orbit (according to observations at distances of thousands of km from the Earth) apparently remain valid also for greater distances from the Sun, i.e. for $m \geqslant 10^{-7}$ g, $N \sim 10^{-5}$impacts/m^2 sec or less.

Between 31 December 1962 and 30 January 1963 AIS Mars-1 registered again an increased density of meteor matter in interplanetary space at a distance from the Earth from 23 to 45 million km. This concentration was identified with neither meteor stream known on Earth. For an aggregate observation time of 4 hours, 104 impacts were noted, whereupon the mean frequency constituted $4.5 \cdot 10^{-3}$ imp/m^2 sec. The spatial density of meteor bodies in this formation was as irregular as in the case of Taurides stream. Separate clusters had a density fluctuating between $1.7 \cdot 10^{-6}$and $6.7 \cdot 10^{-4}$ m^{-3}, while the distance between them varied from 8000 to 190,000 km.

After 30 January 1963 the apparatus for the registration of meteoric particles no longer functioned. This is why it is unknown how long the motion of AIS Mars-1 continued in a medium with increased spatial density of meteor bodies.

The investigations with the help of cosmic rockets ZOND-3 and VENERA-2, launched in 1965, allowed us to measure the spatial density of meteor bodies along the flight trajectory of the rockets in the direction from the Earth's orbit toward the Sun and from the Sun. The registration of meteor particle impacts on these rockets was conducted with the aid of piezoelectric sensors disposed at the opposite side of solar cells, which are sensitive to impacts of particles with masses $\geqslant 10^{-7}$(at particle velocity of 15 km/sec). The surface sensitive to impacts constituted an area of 1.5 m^2.

Most of the time the impact accumulation time was of 4 hours, but in isolated cases it was of 2 minutes, and at times even several days, eventually exceeding one month. Inasmuch as cases of overfilling of counter circuits of the electronic block are always possible with the resulting break in the flow of information, the number of impacts registered in the course of the experiments must be considered as a minimum.

The preliminarily processed data from Zond-3 and Venera-2 are related to measurements along the rocket flight trajectory from the Earth's orbit opposite to the Sun to distance of 47 million km, and toward the Sun to 25 million km.

Plotted in Figures 3 and 4 is the dependence of the number of registered impacts, corresponding to every million kilometer range along the normal to the orbit of the Earth, respectively in the direction from and to the Sun. In these cases the average number of impacts constitutes $5.7 \cdot 10^{-5}$ and $7.8 \cdot 10^{-5}$ imp/m^2 sec. respectively, that is, the quantity of meteor matter in the direction from the Sun exceeded by about one and one half to two times its quantity in the direction at the Sun.

As may be seen, no substantial difference in the density distribution of meteoric particles was observed in comparable experiments. The concentration in the Earth's orbit region to distances of several million km is explained by the coincidence of the moment of registration time with the presence in these regions of meteor streams Perseides and Aquarides for Zond-3 and Taurides for Venera-2.*

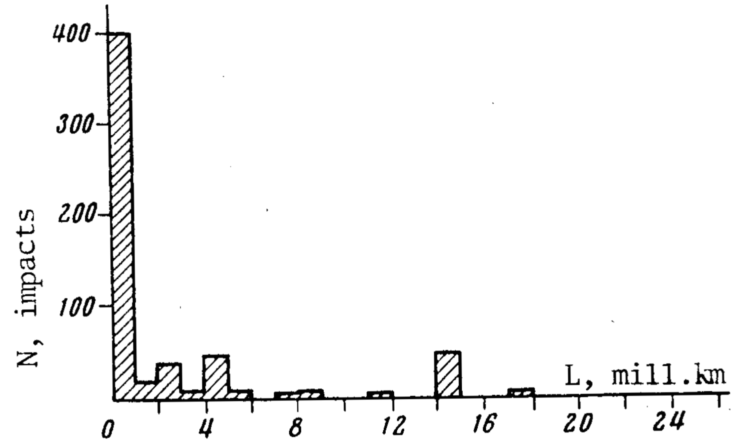

Fig. 4. Same as for Fig.3 but in the direction toward the Sun

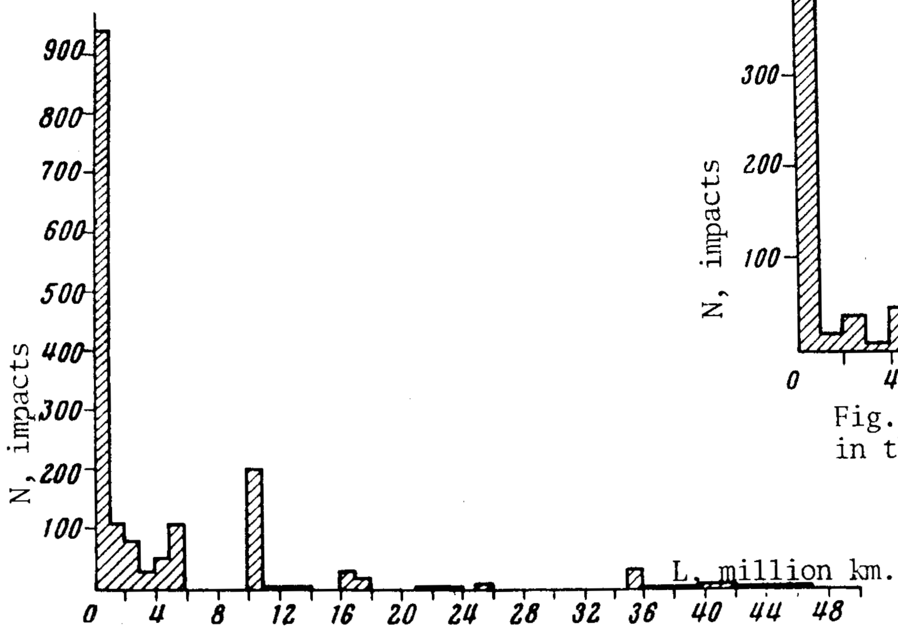

Fig.3. Number of registered impacts corresponding to every million km range along the normal to the orbit of the Earth in the direction from the Sun

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* "Venera" is the Russian transliteration of "Venus".

Inasmuch as the density of meteor matter in interplanetary space is quite irregular, the data obtained in this isolated experiment cannot serve as a basis for any conclusions concerning the distribution of meteor matter in the solar system.

The space rockets Zond-3 and Venus-2 intersected in the course of their flight a series of meteor particle concentrations, part of which belonged to meteor streams well known on Earth (Figs 5 and 6). The extension of separate concentrations fluctuated within broad limits, reaching millions of kilometers. The registered extended concentrations included separate densifications of meteor particles for which the frequency of impacts oscillated from 10^{-1} to 10^{-5} impacts per m^2 sec.

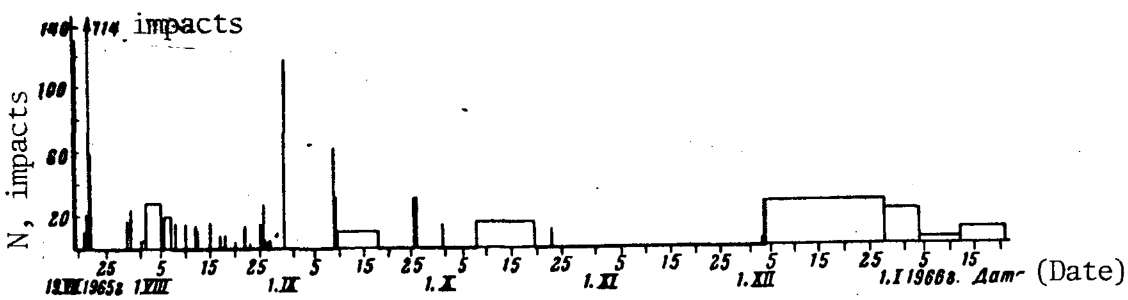

Fig.5. Registration data of meteoric particles along the flight trajectory of ZOND-3

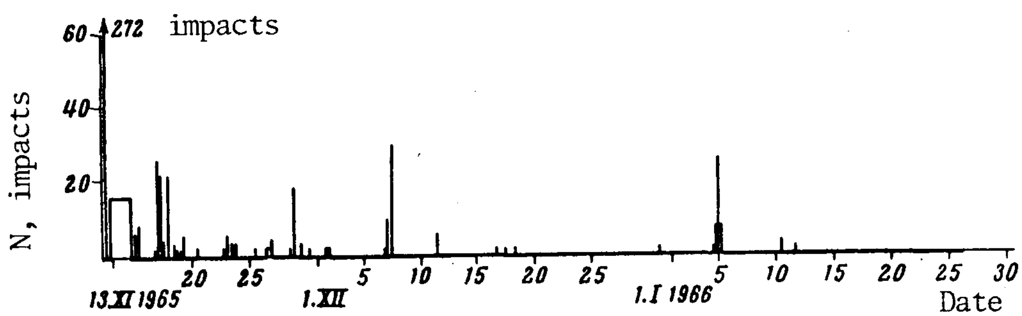

Fig.6 . Registration data of meteoric particles along the flight trajectory of Venera-2

Therefore, the meteor matter is apparently incorporated within the interplanetary space mostly into more or less dense formations.

A conclusion may be derived on the basis of the experiments carried out that the irregularity in the distribution of meteor matter in space is rather a rule than an exception. Are the data obtained on Mariner-4 such an exception? This can be judged only after the materialization of a sufficient number of analogous experiments, though meteor matter density fluctuations by a factor of 2 - 7 were noted on Mariner-4 over different portions of flight trajectory.

The greater the difference in spatial densities of separate concentrations, and and the more they differ in their extension, the more we are convinced that in order to ascertain the rules of meteor matter distribution a systematic accumulation of observation data related to various regions of interplanetary space is indispensable.

In conclusion the author conveys his gratitude to the large team of coworkers having participated in the working out an creation of the apparatus, in the processing of experimental data and in the discussion of the results of measurements.

*** THE END ***

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ABRAHAM, DURGAPRASAD
EVANS, WILLIAMSON
DAVIS, WILLIAMS
KONRADI, HOFFMAN
TEEGARDEN, SERLEMITSOS
VKB, BOLDT, HAGGE
612 HEPPNER
NESS
SKILLMAN
613 KUPPERIAN
DUNKELMAN
McCRACKEN
SECRETAN
FOWLER
HALLAM, KONDO
614 WHITE
FROST
WOLFF
BEHRING, KASTNER
615 BAUER
GOLDBERG
HERMAN
CHANDRA
MAIER
STONE

640 HESS
O'KEEFE
641 MEAD MAEDA
CAMERON
BURLEY, KELSALL
ADLER
READING ROOM
630 GI FOR SS (5)

NASA HEADQUARTERS

SS, SG, SM -usual
SL WILMARTH
BRUNK
FELLOWS
HIPSHER
HOROWITZ
RR KURZWEG
RTR NEILL
USS NAGURNIY
WX SWEET

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235 SEATON
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Wyckoff Vis.Lab.

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